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Effect of the Collision of Comet Shoemaker-Levy 9 on the Appearance of Jupiter in the Near and Thermal IR

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Current estimates for the trajectory of comet Shoemaker-Levy 9 predict that the string of fragments will most likely strike the night side of Jupiter. The target region will not rotate into view until some 1-5 hours after the impact of comet material. Hence, observations of the effects of large impacts on the neutral atmosphere will be limited to examination of residual phenomena that linger hours to days after any dramatic fireball associated with a large airburst has come and gone. Here we attempt to estimate the extent and nature of any alteration to the near and thermal infrared appearance of the planet from its pre-collision state. Emission from a spatially resolved dust cloud of optical depth ~ 0.05, deposited in a layer near the O. 1-mbar pressure level and radiating with the ambient atmospheric temperature, would be easily detected in the 8-μm spectral region. A cloud with at least this optical depth could be produced if $\sim 10^{14}$ g of condensable material with ~ 0.5 μm radius particles were spread over an area of radius 10^4 km in the upper stratosphere, not an unreasonable result in the aftermath of a number of large impacts. The same cloud would also be seen in the near infrared by observing in strong methane and hydrogen absorption bands such as those between 1.7 and 2.3 pm. Large convergence of horizontal winds in the rebound following the rise of a large fireball would be expected to generate vorticity in the region of the impact. Rossby waves or closed vortices produced in the troposphere would probably be detect able by their thermal signature at 18 μm.

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